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Bactrospora cozumelensis sp. nov. from Mexico

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Abstract—*Bactrospora cozumelensis* is described as a new species associated with mangrove forests in Cozumel Island, Mexico. The specimens were collected on *Rhizophora mangle* bark in Punta Sur Ecological Park, Cozumel Island Biosphere Reserve, Quintana Roo, Mexico. This species is characterized by an erumpent to sessile apothecium, laterally carbonized excipulum, and 3-septate ascospores that are slightly constricted in the middle.

Key words—*Arthoniales,* lichens, *Roccellaceae*, taxonomy

Introduction

Bactrospora A. Massal. comprises 37 species of crustose lichenized fungi that grow mainly on the bark of trees (Wijayawardene & al. 2018, Van den Boom & al. 2018, Herrera-Campos & al. 2019). The genus is widely distributed in both tropical and temperate areas but often goes unnoticed (Sobreira & al. 2015). It is characterized by a thallus that is poorly developed, crustose, and associated with photobionts of *Trentepohliaceae*, bitunicate asci with an apical KI+ blue apparatus, and ascospores that are cylindrical to acicular and multiseptate (Egea & Torrente 1993). *Bactrospora* differs from similar genera such as *Lecanactis* or *Opegrapha* by its cylindrical to acicular and multiseptate ascospores, its apical ascal apparatus with a conspicuous KI+ blue ring, its pruinose thallus or disk, and its ascomatal shape (Egea

& Torrente 1993). *Bactrospora* displays four ascospore types (*dryina*-type, *patellarioides*-type, *homalotropa*-type, and *jenikii*-type) and its asexual form produces pycnidia that are immersed or subimmersed in the thallus or substratum and produce variably shaped conidia (Egea & Torrente 1993).

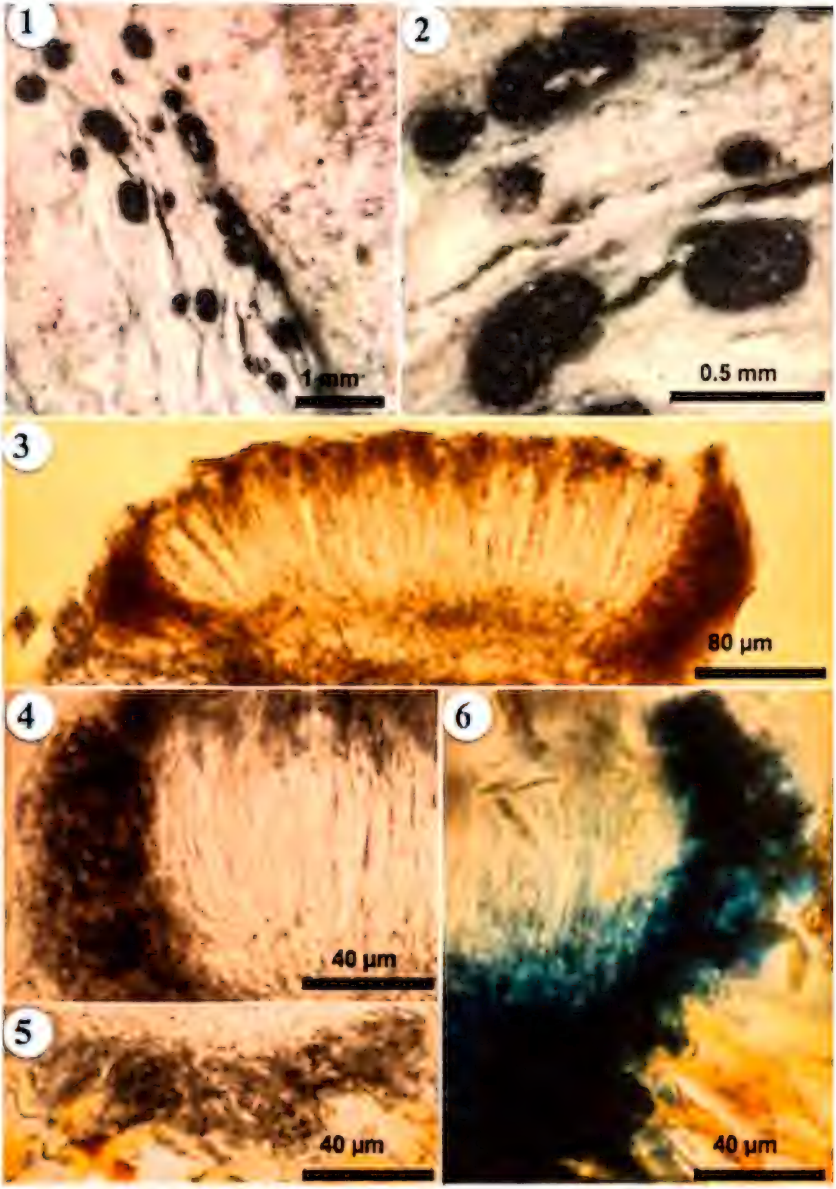
The genus was initially placed in the *Bactrosporaceae* by Rabenhorst (1869: 37, 60, as "*Bactrosporeae*") and this was accepted by Eriksson (1981). Subsequently, it was regarded as a synonym of the *Opegraphaceae* (Cannon & al. 1985, Eriksson & Hawksworth 1991), and later Hawksworth & al. (1995) and Grube (1998) included it in *Roccellaceae* (*Arthoniales*) based on macro- and micromorphological and chemical features. Recent phylogenetic studies treat *Bactrospora* as a genus incertae sedis within *Arthoniales* (Lücking & al. 2016, Wijayawardene & al. 2018).

In the Americas, 17 *Bactrospora* species have been reported, mostly from coastal ecosystems (Egea & Torrente 1993, Egea & al. 2004). Although Mexico is a megadiverse country, the lichen biota is insufficiently studied, and only two *Bactrospora* species have been reported: *B. jenikii* (Vězda) Egea & Torrente from Quintana Roo (Guzmán-Guillermo & al. 2019) and *B. lecanorina* Herrera-Camp. & al. from Jalisco (Herrera-Campos & al. 2019); both species were discovered in tropical forests.

During a mycological survey of mangrove on Cozumel Island, we collected specimens belonging to this genus that could not be assigned to any published species and so propose a new species here.

Materials & methods

The mangrove forests lie within Cozumel Island Biosphere Reserve, in the Punta Sur Ecological Park, 20°16′41″–18′27″N 86°58′05″–87°00′41″W, covering 1114 ha at 0–7 m a.s.l. The climate is tropical with an average temperature of 25°C and a mean annual precipitation of 1570 mm (annual maximum of 250 mm occurring in October and minimum of 40 mm occurring in April; INEGI 2013). The mangrove forests include *Rhizophora mangle* L., *Laguncularia racemosa* (L.) C.F. Gaertn., *Conocarpus erectus* L., and *Avicennia germinans* (L.) L. (Téllez-Valdez & al. 1989). The specimens were collected in Punta Sur Ecological Park on 18 May 2019 on *R. mangle* bark and are deposited in fungal collection "Dr. Gastón Guzmán Huerta" at the Herbarium Escuela Nacional de Ciencias Biológicas of Instituto Politécnico Nacional, Mexico City, Mexico (ENCB) and the Herbarium in Universidad Veracruzana, Xalapa, Veracruz, Mexico (XALU). Latitude/longitude coordinates were obtained with GPS eTrex (Garmin). Morphological examinations were conducted as outlined by Brodo & al. (2001). The specimens were morphologically examined using a Carl Zeiss Primo Star microscope, and hand-cut sections were examined under a Carl Zeiss model Stemi Dv4 stereoscope. Ascospore measurements were made in water



FIGS 1–6: *Bactrospora cozumelensis* (holotype, ENCB—García & Bravo 31a). 1. Gregarious young and mature apothecia on dead wood; 2. Apothecia mature, discoid; 3. Apothecium in transverse section; 4. Excipulum in lateral section; 5. Under side of subhymenium; 6. Excipulum after KI.

at 1000× magnification and only well-developed ascospores lying outside the asci were measured. Amyloidy was tested with Lugol´s solution before and after pre-treatment with KOH 5%. Spot tests were made using standard methods (Brodo & al. 2001). A thin-layer chromatography (TLC) was performed with solvent C (Elix 2014). Measurements of micromorphological characters were taken from rehydrated tissues in water. Terminology is based on Egea & Torrente (1993).

Taxonomy

Bactrospora cozumelensis Y. García, Guzm.-Guill., R. Valenz. & Raymundo, **sp. nov.** FIGS 1–11

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Differs from *Bactrospora incana* by its smaller ascospores, its epruinose apothecia, and its corticolous habit.

TYPE: México, Quintana Roo, municipality of Cozumel, Punta Sur Ecological Park, 20°18′00″N 87°00′36″W, 0 m a.s.l., mangrove forest in a coastal lagoon, on bark of *Rhizophora mangle* (*Rhizophoraceae*), 18 May 2020, Y.A. García & M.A. Bravo 31a (**Holotype,** ENCB).

ETYMOLOGY: *cozumelensis* refers to the type locality.

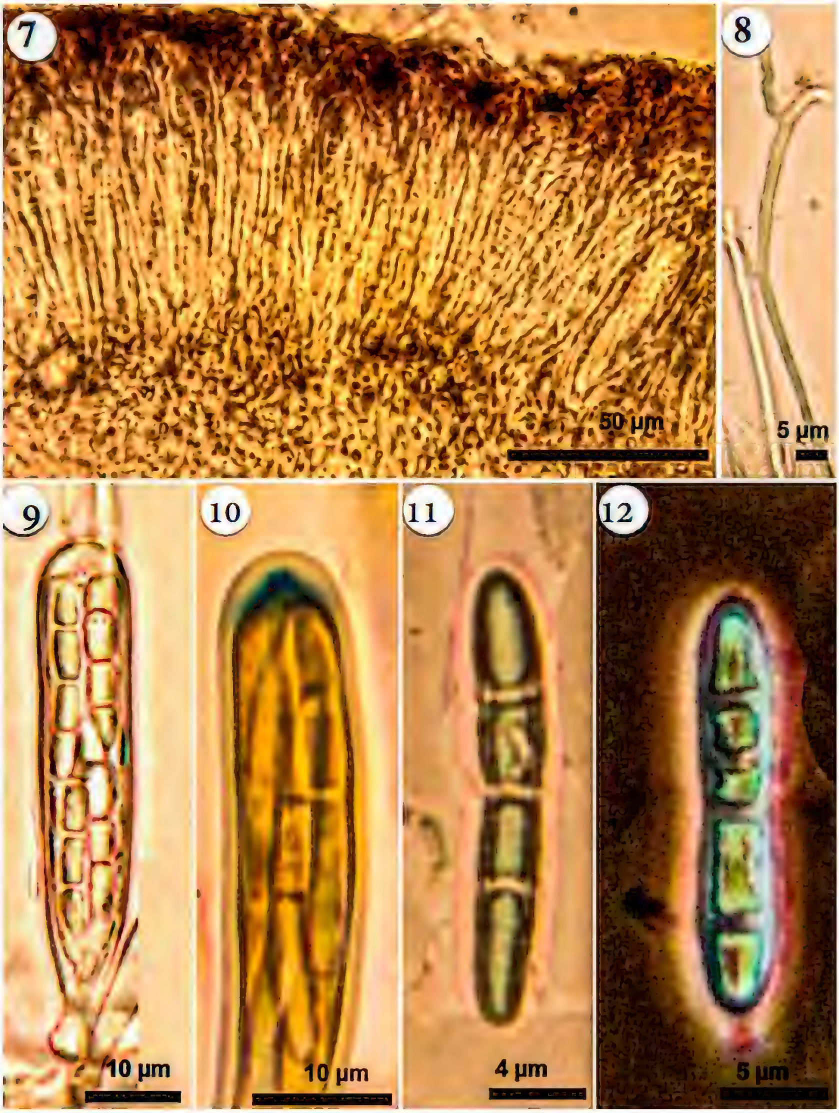
THALLUS crustose, continuous, effuse, thin, whitish, slightly shiny, surrounded by a black prothallus line; I–, K/I–, and Cl–; trentepohlioid ellipsoid cells inside of the thallus; APOTHECIA 0.1–0.3 mm diameter, roundish, dark, with thin margin to immarginate distinguishable for being darker, epruinose, initially erumpent on the bark, turning sessile at maturity, numerous, scattered in the thallus; EXCIPULUM 25–30 µm at the top and 40–60 µm at the base, laterally carbonized, open below the subhymenium, I–, K/I+ deep blue; HYMENIUM (85–)130–200(–230) µm, not inspersed, I+ reddish, K/I–; SUBHYMENIUM 100–130 um, hyaline I–, K/I+ blue. Paraphyses, long, branched, forming a reticulate, light brown pseudoepithecium without pruinose granules, K+ dark olive, I– and KI–; ASCI (40–)45–52(–55) × 8–10 µm (n = 20), cylindrical, hyaline, bitunicate, stipulated; ASCOSPORES eight per asci, (15–)17–20(–23) × (2–)3–4 µm (n = 35), of *jenikii*-type, hyaline, with 3(–4) transverse septa, slightly constricted in the middle.

PYCNIDIA not seen.

CHEMISTRY: K–, C–, UV–. TLC: no substances detected.

ADDITIONAL SPECIMEN EXAMINED: **MÉXICO, QUINTANA ROO, Municipality of Cozumel**, Punta Sur Ecological Park, 20°18′00″N 87°0′36″W, 0 m a.s.l., mangrove forest in a coastal lagoon, on bark of *Rhizophora mangle,* 18 May 2020, Y.A. García & M.A. Bravo 32 (XALU).

ECOLOGY & DISTRIBUTION: Growing on primary branch bark of *Rhizophora mangle* in a mangrove forest situated in a coastal lagoon; known only from



FIGS 7–12: *Bactrospora cozumelensis* (holotype, ENCB—García & Bravo 31a). 7. Hymenium in water; 8. Paraphyses; 9. Asci in water; 10. Asci after KI; 11, 12. Ascospores in 5% KOH.

the type locality. *Bactrospora cozumelensis* was found growing together with other lichens including *Pyrenula cerina* Eschw., *Coniocarpon cinnabarinum* DC., and *Arthonia antillarum* (Fée) Nyl.

Comments—*Bactrospora cozumelensis* is diagnosed by apothecia that are subimmersed when immature and sessile when mature and its 3(–4)-septate ascospores that are slightly constricted in the middle. The similar species *Bactrospora brevispora* R.C. Harris is distinguished by its sessile apothecia, an excipulum closed below the subhymenium, and larger (20–32 × 3–3.5 µm) ascospores (Harris 1990; Egea & Torrente 1993). *Bactrospora incana* Egea & Torrente, which also resembles *B. cozumelensis,* differs by its larger (28–42 × 4.5–6.5) ascospores, densely hairy young ascomata, and epilithic habitus (Egea & Torrente 1993) (Table 1). Neither *B. brevispora* nor *B. incana* have been reported in mangrove forests.

Table 1. Comparisons between *Bactrospora cozumelensis* and related species.

Character	*B. brevispora*	*B. cozumelensis*	*B. incana*
Unicellular hairs on thallus	Absent	Absent	Present
Ascomata size (mm)	0.3–0.8	0.1–0.3	0.2–0.4
Excipulum opening below subhymenium	Closed	Open	Open or reduced to a thin band
Ascus size (µm)	(45–)50–70 × 10–12	(40–)45–52(–55) × 8–10	60–75 × 18–21
Ascospore type	*jenikii*-type	*jenikii*-type	*jenikii*-type
Ascospore size (µm)	20–32(–35) × 3–3.5(–4)	(15–)17–20(–23) × (2–)3–4	28–42 × 4.5–6.5
Number of ascospore septa	3–7	3–4	3–7
Habitus	Epiphyte	Mangrove epiphyte	Epilithic
Distribution	USA, Jamaica (Egea & Torrente 1993)	Mexico (this publication)	Venezuela (Egea & Torrente 1993)

In the Americas, only three other species of *Bactrospora* show the *jenikii*-type ascospores produced by *B. cozumelensis: B. brevispora, B. incana,* and *B. jenikii;* of these, *B. jenikii* with 8–13 septa is the most distinct (Sobreira & al. 2015) while *B. cozumelensis* has the smallest *jenikii*-type spores. Of the three *Bactrospora* species reported in Mexico, only *B. cozumelensis* is found in mangrove forest; *B. lecanorina,* found in a dry tropical forest in Jalisco, has *patellarioides*-type ascospores with more septa (Herrera-Campos & al 2019), and *B. jenikii,* found in sub-deciduous forest in Bacalar lagoon, has larger ascospores (Guzmán-Guillermo & al. 2019).

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